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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/762,499

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Aarti Gupta

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EXAMINER

OCHOA, JUAN CARLOS

ART UNIT

PAPER NUMBER

2123

MAIL DATE

DELIVERY MODE

02/19/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/762,499

Applicant(s)

GUPTA ET AL.

Examiner

Juan C. Ochoa

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11/15/07.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 75-80 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 75-80 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 November 2007 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. The amendment filed 11/15/07 has been received and considered. Claims 1-74 are cancelled. New claims 75-80 are presented for examination.

Information Disclosure Statement

2. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Oath/Declaration

3. The oath or declaration is defective because:
4. It does not identify the mailing address of each inventor. A mailing address is an address at which an inventor customarily receives his or her mail and may be either a home or business address. The mailing address should include the ZIP Code designation. The mailing address may be provided in an application data sheet or a supplemental oath or declaration. See 37 CFR 1.63(c) and 37 CFR 1.76.
5. It does not identify the city and either state or foreign country of residence of each inventor. The residence information may be provided on either an application data sheet or supplemental oath or declaration.

Drawings

6. The drawings are objected to because of the following informalities:
7. As to Figure 7, legends and terms within logic boxes are not visible/distinguishable. Backgrounds of logic boxes do not contrast with their text.
8. Appropriate correction is required.
9. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because:
 10. As to Figure 5, it includes the following reference character(s) not mentioned in the description: 505. In the specification, the reference character "503" has been used to designate both "formulate the k-instance BMC problem (box 503)" and "If the problem is satisfiable (box 503)". It should be "505", as noted in Figure 5.
11. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Interpretation

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12. Office personnel are to give claims their "broadest reasonable interpretation" in light of the supporting disclosure. In re Morris, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. In re Prater, 415 F.2d 1393, 1404-05, 162 USPQ 541,550-551(CCPA 1969). See *also In re Zletz, 893 F.2d 319,321-22, 13 USPQ2d 1320, 1322(Fed. Cir. 1989) ("During patent examination the pending claims must be interpreted as broadly as their terms reasonably allow").... The reason is simply that during patent prosecution when claims can be amended, ambiguities should be recognized, scope and breadth of language explored, and clarification imposed.... An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative process.

13. In the amendment filed 11/15/07, claim 78, recites: "wherein a lazy constraint is used instead of an eager 1-literal constraint denoting an initial value of a flip-flop, wherein an initial value constraint such as (m) is replaced by (m+y)(m+!y), where y is a fresh variable and !y denotes negation of y" and claim 79, recites: "wherein a lazy constraint is used instead of an eager 1-literal constraint denoting an environmental constraint, wherein an environmental constraint such as (m) is replaced by (m+y)(m+!y), where y is a fresh variable and !y denotes negation of y". Application description page 50, paragraph [163], reads:

"Consider a constraint that variable x should always have value 1, which can be enforced by using a 1-literal clause x. In order to make this constraint lazy, we introduce a dummy variable y, and replace the 1-literal clause by the pair of clauses (x+y)(x+y'). Note that if the dummy variable y is never chosen as a decision variable by the SAT solver (e.g. by giving it an arbitrary low score), then these clauses will not imply any value on x. However, if the SAT solver implies a

value 1 on x due to other constraints, then both these clauses are satisfied. More interestingly, if the SAT solver implies a value 0 on x, these clauses will immediately cause a conflict on y, thereby ensuring that the constraint on x is respected. (In some cases, the 1-literal clause on x may even be learned by conflict analysis.)"

Since the language of claims 78 and 79 is not expressly defined in the Application description, Examiner interprets the language of claims 78 and 79 as the "introduction of a dummy variable y" of Application description page 50, paragraph [163].

14. In the amendment filed 11/15/07, claim 80, recites: "environmental constraints". Application description page 48, paragraph [151] reads: "External constraints Ext(e) imposed on a node e in the unrolled design: arising due to the property translation, or imposed by the designers to model environment constraints". Examiner interprets "environmental constraints" as the "external constraints" of Application description page 48, paragraph [151].

Claim Objections

15. Claim 75 is objected to because of the following informalities:
16. Claim 75 lines 17–18 include the misspelled term "external constrain nodes". Examiner interprets as "external constraint nodes" for examination purposes.
17. Appropriate correction is required.

Claim Rejections - 35 USC § 112

18. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

19. Claims 78 and 79 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter

which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The subject matter description of claim 78: "wherein a lazy constraint is used instead of an eager 1-literal constraint denoting an initial value of a flip-flop, wherein an initial value constraint such as (m) is replaced by (m+y)(m+!y), where y is a fresh variable and !y denotes negation of y" and claim 79: "wherein a lazy constraint is used instead of an eager 1-literal constraint denoting an environmental constraint, wherein an environmental constraint such as (m) is replaced by (m+y)(m+!y), where y is a fresh variable and !y denotes negation of y" in the specification is non-existing.

Claim Rejections - 35 USC § 103

20. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

21. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

22. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

23. Claims 75–77 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baumgartner et al., (Baumgartner hereinafter), Property Checking via Structural Analysis (see PTO-892 Notice of Reference Cited dated 5/15/07), taken in view of M. Ganai and A. Aziz, (Ganai hereinafter), "Improved SAT-based Bounded Reachability Analysis".

24. As to claim 75, Baumgartner discloses a computer implemented method for generating an abstract model for a sequential design for verification of a given correctness property (see page 7, 3rd paragraph), comprising: a) unrolling the sequential design time frames up to a finite depth k to create an unrolled design (see page 7, next to last paragraph and page 7, Fig. 2); b) adding interface propagation constraints for each flip-flop in the sequential design, to capture equality between an input and output of said each flip-flop across successive time frames (see page 8, 2nd paragraph); c) adding an initial value constraint for said each flip-flop in a first time frame (see "initial

value" in page 3, 4th paragraph, 1st line); and g) using said unsatisfiable core to derive an abstract model for further verification of the sequential design (see page 7, 2nd paragraph); wherein the said unsatisfiable core is used to mark certain flip-flops and certain external constrain nodes (see page 7, last paragraph and page 8, 1st paragraph), the abstract model consists of combinational fanin cones of only the marked flip-flops and the marked external constraint nodes, such that outputs from the unmarked flip-flops are regarded as pseudo-primary inputs (see page 7, last paragraph and page 8, 1st paragraph).

25. While Baumgartner discloses generating an abstract model for a sequential design for verification of a given correctness property; Baumgartner fails to disclose adding the correctness property constraints at certain or all the time frames, the correctness property is violated on the unrolled design and deriving an unsatisfiable core from the proof of unsatisfiability when the correctness property is not violated, where the unsatisfiable core is a subset of the constraints sufficient for showing that the problem is unsatisfiable.

26. Ganai discloses d) adding the correctness property constraints at certain or all the time frames and e) solving a resulting constraint satisfiability problem to determine whether the correctness property is violated on the unrolled design (see page 731, col. 2, 3rd paragraph); and f) deriving an unsatisfiable core from the proof of unsatisfiability when the correctness property is not violated, where the unsatisfiable core is a subset of the constraints sufficient for showing that the problem is unsatisfiable (see page 731, col. 2, 4th paragraph).

27. Baumgartner and Ganai are analogous art because they are both related to design verification.

28. Therefore, it would have been obvious to one of ordinary skill in this art at the time of invention by applicant to utilize the step of Ganai in the method of Baumgartner because Ganai utilizes a SAT-based bounded reachability analysis algorithm which uses two forms of learning to significantly reduce the search space for the SAT solver (see page 729, col. 1, 2nd paragraph, lines 1–3), and as a result, Ganai reports the following improvement over his prior art: finding bugs in industrial designs which were previously remained undetected via propagation of symbolic expressions represented using a non-canonical two-input AND/INVERTER graph representation and on-the-fly reduction on such a graph representation, such simplified graph representation having significant impact on the performance of SAT-solver; and low computation overhead for the proposed symbolic algorithm, allowing it to fit well with any state space search tool (see page 733, col. 2, 4th and 5th paragraphs).

29. As to claim 76, Ganai discloses a method, wherein a flip-flop is marked, if any of its corresponding latch interface constraints belong to said unsatisfiable core and a flip-flop is marked, if its initial state value constraint belongs to the said unsatisfiable core. (See page 729, col. 2, last paragraph to page 730, col. 1, 3rd paragraph).

30. As to claim 77, Ganai discloses a method, wherein a flip-flop is marked, if any of its corresponding latch interface constraints belong to the said unsatisfiable core and a flip-flop is not marked if only its initial state value belongs to the said unsatisfiable core, in which case a constraint for the initial input is added to the abstract model without

adding the flip-flop. (See page 729, col. 2, last paragraph to page 730, col. 1, 3rd paragraph).

31. As to claim 80, Baumgartner discloses a method wherein environmental constraints are added at said certain or all time frames. (See page 7, last paragraph and page 8, 1st paragraph).

32. Claims 78 and 79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baumgartner taken in view of Ganai as applied to claim 75 above; and further in view of Marques-Silva and Sakallah, (Marques-Silva hereinafter), GRASP: A Search Algorithm for Propositional Satisfiability (see reference [6] listed in the Application description pg. 3 or PTO-892 Notice of Reference Cited dated 5/15/07).

33. As to claim 78, while the Baumgartner–Ganai method teaches almost all of the instant invention as applied to claim 75 above, the Baumgartner–Ganai method lacks using dummy variables.

34. Marques-Silva discloses a method, wherein a lazy constraint is used instead of an eager l-literal constraint denoting an initial value of a flip-flop, wherein an initial value constraint such as (m) is replaced by (m+y)(m+!y), where y is a fresh variable and !y denotes negation of y (see “dummy variable” in page 518, col. 2, 2nd–5th paragraphs).

35. Baumgartner, Ganai, and Marques-Silva are analogous art because they are related to design verification.

36. Therefore, it would have been obvious to one of ordinary skill in this art at the time of invention by applicant to utilize the step of Marques-Silva in the Baumgartner–Ganai method because Marques-Silva develops a procedure for conflict analysis in

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satisfiability algorithms and describes a configurable algorithm for solving SAT (see page 516, col. 1, next to last paragraph, lines 1–3), and as a result, Marques-Silva reports the following improvement over his prior art: a SAT algorithm more efficient than other state-of-the-art algorithms for a large number of SAT instances (see page 516, col. 1, next to last paragraph, last 3 lines).

37. As to claim 79, Marques-Silva discloses a method, wherein a lazy constraint is used instead of an eager I-literal constraint denoting an environmental constraint, wherein an environmental constraint such as (m) is replaced by $(m+y)(m+\neg y)$, where y is a fresh variable and $\neg y$ denotes negation of y (see “dummy variable” in page 518, col. 2, 2nd–5th paragraphs).

Response to Arguments

38. Applicant's arguments filed 11/15/07 have been fully considered, but they are not persuasive.

39. Regarding the IDS objections, deficiencies remain.

40. Regarding the Oath/Declaration objections, deficiencies remain.

41. Regarding the drawing objections, deficiencies remain.

42. Regarding the claim objections, claims are cancelled.

43. Regarding the rejection under 102 and 103, claims are cancelled and those rejections are withdrawn. Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection. In the instant rejection, Examiner has elaborated prior art disclosures of new claims.

Conclusion

44. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

45. Examiner would like to point out that any reference to specific figures, columns and lines should not be considered limiting in any way, the entire reference is considered to provide disclosure relating to the claimed invention.

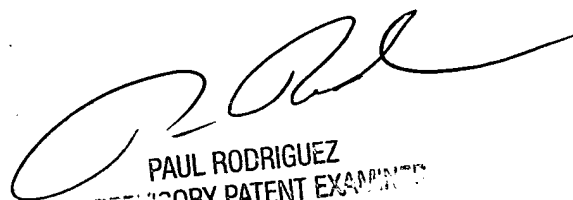
46. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Juan C. Ochoa whose telephone number is (571) 272-2625. The examiner can normally be reached on 7:30AM - 4:00 PM.

47. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached on (571) 272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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48. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

*** *JP* 2/12/08


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